Validation of PestLCI 2.0, an updated and expanded model to estimate pesticide emissions for use in LCI

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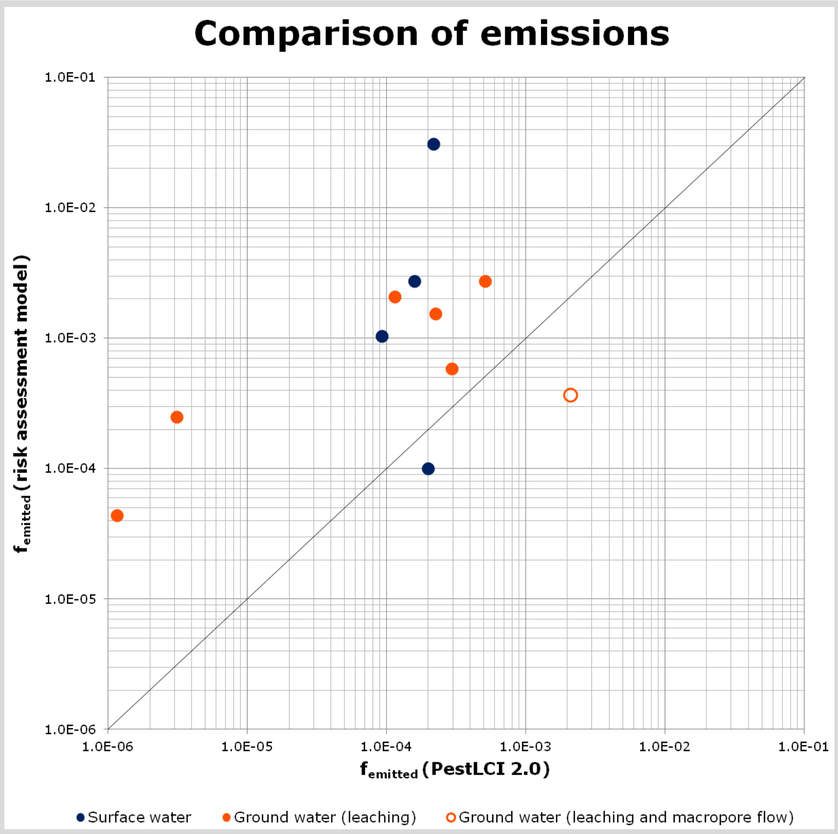
AIMS

PestLCI 2.0 is a Life Cycle Inventory model to calculate pesticide emissions from the technosphere (the agricultural field) to 3 environmental compartments: air, surface water and ground water.

The model was recently updated. The algorithms to calculate pesticide fate were updated and expanded to include preferential flow. The spatial usability of the model was widened to cover all of Europe. In addition, the database of active ingredients was expanded.

The aim of this poster is to illustrate
(1) how the model performs in comparison with risk assessment models for pesticide emissions to surface and ground water.
(2) how toxicity impacts depends on the applied pesticide emissions quantification approach.

COMPARISON WITH RISK ASSESSMENT MODELS



Pesticide emissions obtained by PestLCI 2.0 were compared to pesticide emissions obtained by 3 (FOCUS) risk assessment models:

- Surface water emissions (4 scenarios) with MACRO 4.3 (in SWASH).
- Ground water emissions via soil matrix leaching (6 scenarios) with FOCUSPEARL 4.4.4.
- Ground water emissions via leaching and macropore flow (1 scenario) with MACRO 4.3.

Database data from PestLCI 2.0 most similar to the FOCUS scenario data (used for risk assessment models) were used for the scenarios' spatial and soil data.

Results:

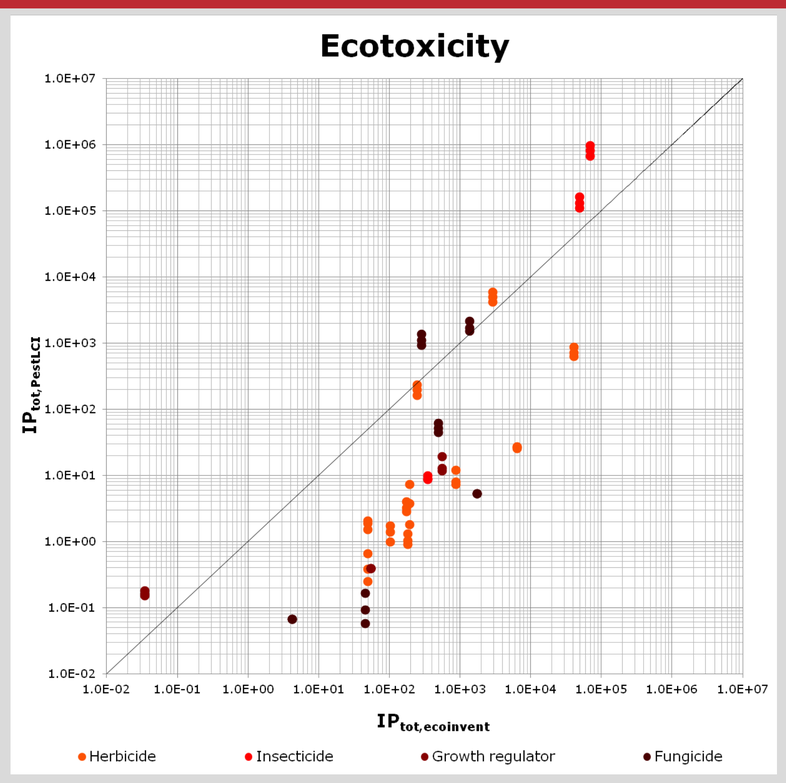
- Modelling results are in reasonable agreement.
- Generally, risk assessment model emission results > PestLCI 2.0 emissions results. Consequence of modelling approach: realistic worst case vs. realistic avg. estimate.
- Macropore modelling approach in PestLCI 2.0 might overestimate emissions to ground water but data demand of PestLCI macropore model is realistic for LCA.

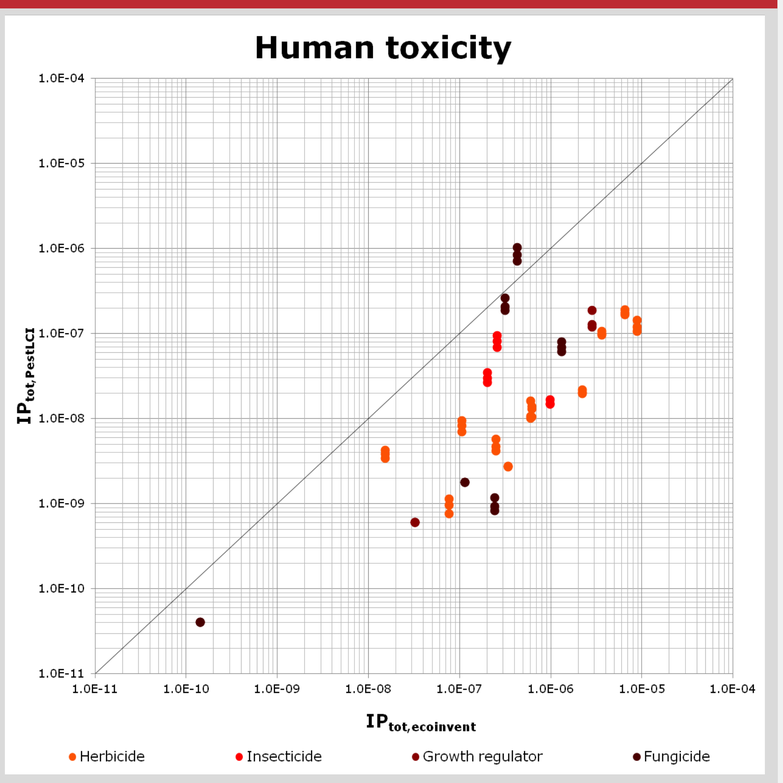
DEPENDENCY OF TOXICITY IMPACTS ON INVENTORY APPROACH

Human toxicity and ecotoxicity impacts for 23 pesticide active ingredients under various circumstances were calculated using 2 LCI approaches:

- PestLCI emission quantification of pesticides to air and surface water in combination with corresponding USEtox characterization factors.
- Ecoinvent emission quantification of pesticides (agricultural soil = 100%) in combination with corresponding USEtox characterization factors.

The results reveal that the toxicity induced impact potentials differ considerably, depending on the chosen inventory approach. The ecoinvent approach in general is 2-3 orders of magnitude more conservative than the PestLCI 2.0 approach.





CONCLUSIONS

- Pesticide emissions calculated by PestLCI and the FOCUS risk assessment models indicate a reasonable agreement between the models. Emissions caused by macropore flow might be (somewhat) overestimated by PestLCI 2.0, refinement of macropore approach applied in PestLCI 2.0 will however increase data and user demands.
- Toxicity impacts calculated applying the PestLCI 2.0 inventory approach are considerably lower than those calculated with the ecoinvent approach. Both approaches are however considered equally valid. The question is if this is defendable.

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